A Living Military System On The Verge of Annihilation

A Monograph
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ABSTRACT

A LIVING MILITARY SYSTEM ON THE VERGE OF ANNIHILATION, by Major Madelfia A. Abb, United States Army, 55 pages.

The explanation to the phenomenon of how a military unit, which seemingly on the verge of annihilation, still manages to survive and fight effectively, lies in the understanding that a military organization is a living system.

Recognizing the parallels between a living system and a military system's need to survive and prosper within an environment full of positive and inimical changes, this study explores the world of living systems to identify the mechanisms and processes for surviving and sustaining combat effectiveness within a military system. The emerging understanding of living systems provides a valid theoretical framework for the exploration. The theory of living systems, as developed by Dr. Fritjof Capra, and the Santiago theory of cognition, as developed by Humberto Maturana and Francisco Varela, form the foundation of the analysis. Subscribing to the notion that the concept of self-preservation and self-organization of a living system are analogous to the terms of living, surviving, and prospering, the explorative study analyzes military systems at the tactical level of war.

The study reveals three conclusions. First, a military system is a living system for it possesses human system and battlefield operating systems (BOS), both representing self-organizing networks within the system; has the natural attribute of being organizationally closed but open system; and has multi-leveled cognitive decision-making process. Second, these three criteria for living make up the components and processes that allow military systems, who are facing overwhelming odds, to spontaneously behave in a way that facilitates, what can be viewed as, miraculous survival and sustained combat effectiveness. Third, by viewing the enemy as a living military system, it leads to the discovery of planning imperatives that are applicable to designing military operations focused at exploiting and manipulating the enemy's survival ability and combat effectiveness. The study presents two case studies from the 1950 Korean War to illustrate the utility and significance of these three conclusions.

The emerging paradigms discovered in the study of chaos, complexity, and non-linearity, are leading people to shift from seeing the world as a machine to seeing it as a living system. For military planners, they need to follow the trends and begin to see the enemy as a living military system. The shift in view allows planners to develop innovative and creative military operations to compel the enemy to a desired will. Perhaps this shift of mind gets planners closer to attaining, what Sun Tzu called, the "acme of skill"—the skill to subdue the enemy without fighting.

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INTRODUCTION

The near presence of death and the prospect of meeting it at the next moment, move men in many curious and contrary ways.

- S.L.A. Marshall, Men Against Fire [1]

The annals of military history display numerous examples of military units, seemingly on the verge of annihilation, somehow manage to survive and fight effectively. Against all odds, human beings do move in curious and contrary ways. This is a phenomenon often dismissed as an anomaly for it defies classical Newtonian-based laws and understanding. Such anomalies exist because traditional conceptual paradigms are unable to provide a proper rationale.[2] The laws of physics, statistics, linearity, and mechanics predict imminent destruction and death with no chance of survival for a military unit facing overwhelming odds. From a mechanistic view this prediction is inevitable. However, when a military unit survives, mechanistic paradigms are unable to offer a logical explanation. When Newtonian approaches fail, it sets the world for a scientific revolution in search for a new body of understanding to explain some natural anomalies.[3] New theories emerge to tackle and confront anomalies from a very different perspective.[4]

The main premise of this monograph is that viewing military organizations as living systems offers a set of paradigms never before understood and convincingly provides a logical and realistic rationale to perplexing anomalies; hence, the explanation of how military units survive and fight effectively amidst destruction lies in the understanding that a military organization is a living system. The emergence of living system theory is changing how successful organizations should be viewed. The shift from viewing an organization from a machine to a living system is a new and revolutionary scientific approach. This shift is causing a tension as scholars have become

accustomed to understanding an organization as a machine but also know an organization needs to behave like a living system. Scholars recognize an organization needs to have the attributes of adaptability, flexibility, self-renewal, resiliency, learning, and intelligence in order to survive successfully, endure, and flourish within an increasingly chaotic and complex environment.[5] Since "these attributes are found only in living systems," viewing a military organization as a living system presents a valid analytical approach to understanding the phenomenon of survival amidst destruction.[6]

While this monograph complies with and recognizes the utility of systems theory, restricting the analysis of the phenomenon in question at the tactical level of war within the context of conventional battles does not present a contradiction. For the record, the analysis contained herein, does recognize the interconnection and interrelationship between political systems and military systems. It subscribes to Carl von Clausewitz's dictum that "war is a continuation of policy" in which the military system is the tool used to execute and wage war. The study also acknowledges operational art as the forum through which the strategic aim is translated into the mechanics of tactical action. These restrictions and recognized dictums are necessary to prevent confusion in the presentation of difficult concepts and ideas. These are the parameters that form the boundary of this study.

The study combines a theoretical analysis with historical case studies to propose a new and holistic scientific explanation to the phenomenon of survival amidst destruction. Before embarking on a theoretical analysis of the phenomenon, establishing the applicability and criteria of the living systems theory as a valid analytical framework is in order. Section I of this monograph provides this foundation by reviewing how theories of

living systems emerged and challenged the ebb of Newtonian thinking. From this review, the applicability of the living systems theory becomes apparent. The review also introduces Dr. Fritjof Capra's theory on living systems. A theoretical physicist and author of *The Web of Life,* Capra unified past and valid paradigms to develop a universal understanding of living systems. His theory forms the foundation of this study's analytical framework.

Section II presents the criteria of living systems, providing the scientific definition for each criterion of pattern organization, dissipative structure, and cognitive process. The cognitive process is the most vital criterion as it is the unifying element on which Capra's theory depends. According to Capra, the existence of a cognitive process coupled with autopoietic (self-making or self-organizing) patterns of organization and structures distinguishes living systems from non-living systems. Capra proposes that the Santiago theory of cognition provides the most accurate and realistic understanding of life's cognitive process. The importance of the third criterion merits a dedicated section. As such, Section III presents the fundamental essence of the Santiago theory of cognition. It serves to explain living as a process of cognition. In sum, both sections II and III establish a theoretical analogy between the living process and the surviving process.

Having defined the criteria of living systems, Section IV posits the idea that a military organization is a living system. This section serves to transform the concepts of living system theory within the context of the military realm, redefining the criteria of living system using military terms, components, and subsystems of a military system. Viewed from the theoretical understanding of living systems with the postulated analogy of living and surviving, Section V proposes a scientific explanation of how a military unit

is able to survive and fight effectively though it is on the verge of annihilation. The section reveals the components of survival within a military system. The 1950 Korean War provides historical examples by which to illustrate the survival mechanisms and processes and sustainability of combat effectiveness amidst annihilation. As a final part, Section V presents two case studies from the war.

Though this study explores the world of living systems to understand the phenomenon of survival of a military system facing impending destruction, the arising conclusions offer another set of perspectives applicable to military warfare. The resulting conclusions from the following theoretical analysis and historical illustrations offer planning imperatives by which to design a campaign against a living enemy system. In understanding a military system, the understanding of the enemy as a living military system also arises. Section VI provides the discussion of these ideas. Section VII serves to unify the effort of the analysis into concise conclusions.

This monograph strongly proposes that by viewing an enemy as a living military system, a military planner is able to develop innovative and creative ways to dominate an enemy. Innovative and creative planning depends on a planner's shift of mind—a shift from viewing the enemy as a machine to a living system. This shift of mind begins with an understanding of how the theory of living systems emerged from the failure of viewing the living world as a machine. Thus, the study begins with the following section to highlight the reasons why the nature of life is best understood from a living systems perspective.

SECTION I: Emergence of a Unifying Theory of Living Systems

New and unsuspected phenomena are, however, repeatedly uncovered by scientific research, and scientists have again and again invented radical new theories. History even suggests that the scientific enterprise has developed a uniquely powerful technique for producing surprises of this sort. If this characteristic of science is to be reconciled with what has already been said, then research under a paradigm must be a particularly effective way of inducing paradigm change.

- Thomas Kuhn, The Structure of Scientific Revolutions [7]

The ubiquity of increasing complexity and chaos of life and nature mandated a series of paradigm shifts through which the development of the theory of living systems emerged. Presently, the world is in the middle of a scientific revolution, a period of time when new paradigms are either building upon or invalidating existing ones.[8] The shifts in paradigms represent the struggle to explain anomalies and phenomena. As Newtonian-based approaches dismiss too many phenomena as unknown anomalies, their validity and reliability are in question. The following review highlights the emergence of the theory of living systems as a result of invalidating the framework of mechanism, linear thinking, simplicity and order; this framework inadequately provides a comprehensive understanding of a living world.

What life is and how living occurs are by far the most researched phenomena in science. Simple and complex living organisms became the subject of many studies that sought to develop a model for a living system. The terms living organism and living system became synonymous concepts. Ironically, the first types of living system models did not comply with systems theory. Heavily influence by prevailing paradigms, the first model complied with the prevailing Newtonian thinking. Thus, viewing a living system as a clockwork-like machine was the first model.

The machine model explains life as a mechanistic process understood from the behavior of components. From this mechanistic framework, analyzing each component

separate from the total living system yields an understanding of how living occurs.[9] Newtonian physics provided the mathematical equations to explain the linear cause and effect, or behavior, of the "various" parts of a living system. Physiologists William Harvey successfully explained the phenomenon of blood circulation in living beings using the mechanistic approach.[10] However, using the same approach, Harvey and other physiologists failed to explain other bodily functions like digestion and metabolism. They failed "because the phenomena the physiologists tried to explain involved chemical processes that were unknown at the time and could not be described in mechanical terms."[11]

Modern chemistry revealed the non-linear interrelationship between complex chemical processes and bodily functions of living organisms. This revelation brought forth the realization that a purely mechanistic approach cannot create a coherent understanding of a living system. Immanuel Kant, a well-known systematic philosopher, argued living systems could not be viewed mechanistically for the very reason that the parts of a machine interrelate differently than the parts of a living organism.[12]

> In a machine according to Kant, the parts only exist for each other, in the sense of supporting each other within a functional whole. In an organism the parts also exist by means of each other, in the sense of producing one another. Organism is an organized and self-organizing being.[13]

"The behavior of a living [system] organism as an integrated whole cannot be understood from the study of its parts alone."[14] For the whole is more than the sum of its parts.[15] From the systems perspective, behavior can no longer represent an effect as a result of a cause. For a particular behavior is not always an effect directly proportional to the cause. Clearly, a living system is much more complex than a machine, it is a system that behaves in a very non-linear manner.[16]

A living system consists of various parts and embedded systems. The organization of these parts and systems became the focus of the field of organismic biology. Organismic biology stemmed from the principles of the general theory of systems. Systems thinking is "the understanding of a phenomenon within the context of a larger whole."[17] Through the application of systems thinking, organismic biologists redefined a living system as an "integrated whole whose essential properties arise from the relationships between its parts."[18] Thus, a biological organism became the second model for a living system.

Organismic biology brought forth a shift in the approach of analyzing organisms, or living systems, from a functional view to an organizational view. It is an analytical framework that confronted the utility of extending linear thinking to living systems. Function is essentially a mechanistic concept completely different from the systems concept of organization.[19] The acceptance of a biological organism as the model reflected a shift from a mechanistic and linear thinking process to systems thinking. Though organismic biology still failed to provide a holistic and comprehensive understanding of living, it uncovered the importance of understanding the configuration of and relationship among components within a living system.[20] How the structure and components of living systems facilitate living and surviving remained unknown.

Kant was the first to use the term self-organization to define the nature of living organisms.[21] Nature is neither linear nor simple.[22] A living organism "organizes itself, and does so in each species of its organized products" for the purpose of self-preservation and survival.[23] Living systems, like organisms, must be creative and innovative as they strive to sustain themselves in a dynamic environment that often presents inimical

challenges. Self-preservation, survival, and continued living were somehow related to the process of self-organization.

The current concept of self-organization emerged from the field of cybernetics, the study of communication and control processes in living and non-living systems. Like organismic biology, systems theory forms the foundation of cybernetics. Cyberneticians define self-organizing systems as open systems, all interconnected in complex and non-linear ways.[24] Hence, the model of living systems expanded. Cyberneticians discovered living systems are open systems since they are able to exchange information, matter and energy with their environment.[25] Additionally, as open systems, living systems operate "far from equilibrium that continually renew themselves through reciprocal interactions with their environment."[26] Living systems have the capacity to "spontaneously create new forms of order, behavior, and structure" within disorder and chaos.[27] It is the notion of self-organization that facilitates living, adapting, and surviving in living systems. A mechanical and linear framework cannot predict self-organizing behavior nor explain why such behavior occurs. The field of cybernetics came close to an answer as it focused on the aspect of control and decision making within a living system. But it took a review of past theories to finally form a unified understanding of what is currently known as the theory of living systems.

From analyzing a singular cellular organism to a multi-cellular organism, the increasing degree of complexity that was discovered led researchers to think within the framework of non-linearity, systems thinking, and complexity. This framework also led to the understanding that the behavior of "living" came from understanding the living system as a whole. The whole system cannot be understood from only the functional

parts. Living systems comprise of networks, all interconnected and interrelated. Additionally, analyzing the environment in which the whole living system resides is necessary in order to develop a holistic comprehension of living. The dynamic interactions between living and non-living systems and their environment became a vital research topic for it further added to the understanding of how living occurs. This latter realization paved the way for scientists to examine how living systems decide how to and what to respond with based on their interactions with other systems and their environment. Dr. Fritjof Capra is a scientist who explored the sea of paradigms with the hopes of synthesizing a new universal understanding.

Capra, a theoretical physicist who received his PhD from the University of Vienna and author of *The Web of Life*, offers a unified view of mind, matter, and life. Through his synthesis of valid and past paradigms and systems approach, he developed a unified and universal theory on living systems. Capra's theory is unified and universal as it looks beyond physical sciences and taps into the paradigms developed from social science, philosophy, ecology, human-based physiology and psychology, quantum physics, thermodynamics, theory of relativity, ecosystem, systems theory, cybernetics, microbiology, genetics, self-organization, mathematics of complexity, and cognitive sciences. He recognizes that science itself cannot provide an accurate and comprehensive systems explanations to all natural anomalies.[28]

Capra's main focus is to understand the nature of life by identifying "a set of general criteria by which" to "make a clear distinction between living and non-living systems."[29] His synthesis serves "to express those criteria in terms of [the] three

conceptual dimensions."[30] Capra theorizes that there are three key criteria of a living system. He calls these criteria patterns of organization, structure, and life process.

The following section describes Capra's theory of living systems and defines his three criteria of living and the nature of life itself. It serves to begin the development of the understanding that forms the foundation of this monograph's theoretical and analytical framework. Lastly, the section introduces the Santiago theory of cognition, explaining the critical aspect of the cognitive process in the process of living.

SECTION II: Theory of Living Systems

The concepts emerging from the science of living systems hold tremendous promise for the future of humankind.

- Mark D. Youngblood, Life at the Edge of Chaos [31]

Patterns of organization, dissipative structure, and life process are three criteria of a living system postulated by the Capra's theory of living systems. These three criteria are all interdependent and must exist together in order for a system to be labeled a living system. The nature of each criterion possesses its own degree of complexity. When all three are fully integrated, they portray a high degree of order and logic showing the detail and dynamic intricacies of the web of life. It is the nature of combat, fundamentally, to disrupt and destroy the integrated logic that emerges as life.[32]

The pattern of organization describes the "abstract mapping and configuration of relationships among the system's components that determines the system's essential characteristics."[33] Both living and non-living systems have a pattern of organization. Consider a car as an example of a non-living system. The typical schematic of a car has four tires, steering wheel, engine, fuel tank, and seats. Each of these items relate to each

other characteristically known to us as that of an automobile. The pattern of organization, or relationships among the components is consistent with the idea of a moving vehicle: the steering wheel relates to the tires to provide the direction of the moving vehicle; the engine relates to the system as it provides the structure that produces energy for movement; the fuel tank relates to the engine to provide the source for energy; and so on. This list gives an expression of linear, cause and effect relationships. On the contrary, all the relations are interrelated and complex. The tires of the car would not move without the relations with the engine and fuel. The interconnectedness of components with each other, termed as pattern of organization, is vital in understanding the whole automobile as a system. However, a car is a non-living system for it lacks a certain type of pattern of organization.

All living systems have a pattern of organization that is autopoietic in nature. An autopoietic system is one whose pattern of organization "is a networked pattern in which the function of each component is to participate in the production or transformation of other components in the network."[34] "Living beings are characterized by their autopoietic organization."[35] This is a characteristic which non-living systems do not have—the ability to self-bound, self-organize, self-generate, and self perpetuate.[36]

A living being is an autonomous system that exists within a self-created boundary. Organizationally, a living system is closed within its created boundary. "This organizational closure implies that a living system is self-organizing in the sense that its order and behavior are not imposed by the environment but are established by the system itself."[37] Yet, it is an open system so that the flow of energy, information, and matter occurs between itself and its environment.[38] A living system must have a way to interact

with its environment to obtain both the energy and resources to sustain self-making and self-organization processes. Through its organizationally closed structure and open system characteristics, a living system's autopoietic process facilitates the formation of new structures and new patterns of behavior to maintain its organization and survive within the environment it exists.

Living systems' autopoietic networks inherently possess feedback and regulation mechanisms that receive inputs from their internal system and external environment. These inputs influence the shaping of behavior and response in the future. The non-linear relationships between the production components of the systems' networks facilitate the systems' self-organizing processes using these inputs.[39] A biological organism, as an example, is a living system due to its ability to self-organize. The nucleus of a living cell contains DNA/RNA, protein synthesis processing, and energy-making components that together allow the self-making nature of a cell to occur. The response of any living system depends on its structure. Both non-living and living systems have some form of structure. However, only living systems have dissipative structures. This is the second criterion.

The term dissipative refers to the attribute of a structure that uses and loses energy.[40] It is important to first define what a structure is as used in the theory. Structures are defined as the physical embodiment of a living system's pattern of organization. The structures describe the system's shape, chemical composition, and components.[41] Consider the previous example of the car. The physical structure of a specific car that defines it as a drag race car consists of a single driver seat, two oversized rear racing tires, two smaller sized front racing tires, a large horsepower engine, and so

forth. The structure of a system, while it has a similar pattern of organization as other systems, defines the physical attribute into a specific component. There are basic organizational relations among components that describe a system and shared by like systems. Any moving four-wheel vehicle is known as a car. However, a family sedan is structurally different from drag or racing cars. A drag car with two oversized rear tires still maintains a pattern of organization consistent with the schematic of a car for the relations among a moving vehicle's functional components still exist. The two-oversized rear racing tires, however, changes the structure of a car and distinctly classifies the car as a drag race car. Structures are not unique criteria for living systems. What is unique is a living system's dissipative structure.

The term dissipative is related to the whole phenomenon of self-organizing. The law of entropy states closed systems work toward equilibrium while expending unrecoverable energy. Once at equilibrium, the closed system is still. From a living system perspective, such equilibrium equates to death.[42] In contrast, a living system is an "open system operating far from equilibrium" that require replacement of expended energy.[43] A series of bifurcations continually move dissipative living systems away from equilibrium. Bifurcations are points of instability "at which dramatic and unpredictable events take place, where order emerges spontaneously and complexity unfolds."[44] This is the most intriguing and fascinating aspect of the theory of dissipative theory. Order amidst the sea of disorder is all part of a living system's world. Dissipative structures are sensitive to small external fluctuations though they keep themselves in a continual dynamic state.

How living systems respond to these fluctuations as defined by their structures is difficult to predict. From the understanding of non-linear autopoietic interconnected components and dissipative structures, the difficulty is due to the self-organizing ability of living systems. A living system is an open system operating far from equilibrium and has internal feedback loops, whose self-organizing nature lead to spontaneous emergence of new structures and new forms of behavior described mathematically by nonlinear equations.[45] Additionally, living systems are historical beings by nature. The response to a fluctuation may either be new or similar to those the systems have witnessed in the past. Living systems are able to remember their initial states. The relationship between their structure and history is evident in their responses but also a characteristic of all living systems.[46] Much to the dismay of many deterministic researchers, uncertainty and unpredictability are part of the nature of living.

Other researchers have attempted to understand the controlling aspect that elicits a system's response. How do the autopoietic components work with the structure such that together they spontaneously emerge new forms of behavior? This type of question led to the discovery of the third criterion of living—cognitive process.

The cognitive process and aspect of living comes from the study of cybernetics and neural systems. Discovered by Dr. Humberto R. Maturana and Francisco J. Varela, the Santiago theory of cognition provides the fundamental understanding of a living system's cognitive process. Cognition is a process that links both dissipative structure and autopoietic pattern of organization in living systems. It is a process identified as the third criterion of living systems, for it is a process not found in non-living systems. "In the emerging theory of living systems the process of life—the continual embodiment of

an autopoietic pattern of organization in a dissipative structure—is identified with cognition, the process of knowing."[47] Section III further elaborates the analogous relationship between living and cognition through the explanation of the Santiago theory of cognition.

SECTION III: The Santiago Theory of Cognition

Living systems are cognitive systems and living as a process is a process of cognition. To live is to know.

- Humberto R. Maturana and Francisco J. Varela [48]

The Santiago theory of cognition proposes a description of how a living system interacts with its environment and explains how its structure and autopoietic network relates to each other.[49] The action of interacting with other systems and the environment, and self-organization occur simultaneously. A living system cognitively responds spontaneously based on its interactions. According to the Santiago theory, this cognitive response is an action performed by the system itself. It is not other systems or the environment that determine how and what a living system will respond with. This view is far different from the old linear and mechanistic view that the environment controls how living systems will change through time. The cognitive process defined by the Santiago theory places the living system as the controller of its own destiny. The theory boldly suggests, living, as a process is a process of cognition.[50]

The cognitive process of living systems makes a clear distinction between structure and process. Consider the following: the human brain is different from the human mind. The brain is a physical structure where the process of mind occurs. Mind is not a thing but a process, a mental process.[51] All mental processes exist in all autopoietic networks. Temporarily put aside the traditional definition for the words

mental, mind, and cognition and their association with the human being and consider a view developed by the scientists who discovered the Santiago Theory of Cognition. Associate these words strictly to the idea of process beyond the idea of human thinking. Cognition as a process can occur even in the simplest organisms.

> A bacterium, or a plant, has no brain but has a mind. The simplest organisms are capable of perception and thus of cognition. They do not see, but they nevertheless perceive changes in their environment—differences between light and shadow, hot and cold, higher and lower concentrations of some chemical, and the like. The new concept of cognition, the process of knowing, is thus much broader than that of thinking. It involves perception, emotion, and action—the entire process of life. In the human realm cognition also includes language, conceptual thinking, and all the other attributes of human consciousness.[52]

From this new concept, brings forth the idea that living systems are beings with an awareness of their environment. For human systems, they are aware of both the environment and themselves. A living system perceives and relates with its environment cognitively. It interacts with its environment described as structural coupling.

Structural coupling is an "embodied action." It is an autopoietic system's action of continual structural change, coupling to its environment structurally.[53] While the environment provides the perturbations that trigger a living system to respond, it is still up to the living system to determine which perturbations it will respond to if it even decides to respond. Whatever the response is, it will always be dependent upon the system's structure. There are two categories of responses that cognitively occur simultaneously.

The purpose of the first response is to maintain and sustain its autopoiesis components and processes. The second is to "bring forth a world."[54] The interconnected components of a system are continually transforming by responding "to a selected

disturbance" from the environment "by rearranging its patterns of connectivity." The system is never the same from the first perturbations it responded to. The system develops as it structurally couples with its environment. "Since these structural changes are acts of cognition, development is always associated with learning."[55] Additionally, these structural changes are choices in which a living system made; choices not made by the environment.

The interaction just described is not at all linear. A living system has the freedom to determine its own fate since it can respond in many ways. Additionally, it does not rely on the environment and the interaction it has with other systems to determine when and how to respond and what to respond with. Systems that choose to remain static and make no responses to environmental perturbations eventually die. With the control of its behavior, a living system's response is difficult to prediction. Prediction is possible in shorter periods of time but not in longer periods of time. The only accurate prediction one can safely make is a living system response is uncertain. This uncertainty is directly due to the complex and nonlinear nature of living systems facilitated by the innate cognitive process of a living system. Thus, knowing or cognition is "an effective action, an action that will enable a living being [system] to continue its existence in a definite environment as it brings forth its world."[56]

As described earlier, the term living system became synonymous with a living biological organism. Capra's theory on living systems does incorporate aspects of what is known about organisms as obtained from the field of biology. However, to reduce individual human systems and collective human systems into biological systems leads to a serious flaw in any analysis of human phenomena. As Capra explains,

> Multi-cellular living systems differ in degrees of autonomy of their components. In organisms the cellular components have a minimal degree of independent existence, while the components of human societies, individual human beings, have a maximum degree of autonomy, enjoying many dimensions of independent existence...Social unity of human societies is based on the exchange of language. Human social systems exist also for their components, the individual human beings. It amplifies the individual creativity of its components, as that system exists for these components...Organisms and human societies are therefore very different types of living systems.[57]

This monograph uses a theoretical framework that recognizes the distinct difference between biological organisms and human systems.[58] There is a certain aspect of biological organisms that is applicable and relevant to understanding the phenomenon of survival. The biological organisms have the ability to "maximize sustainability" to increase their potential for continued existence within an environment full of inimical changes.[59] Understanding how biological organisms maximize sustainability, can lead to a greater understanding of how other complex living systems (like human and military systems) survive.

The notion of maximize sustainability is essentially a process that helps achieve self-preservation in living systems. Within the context of the living systems theory and the Santiago theory of cognition, the terms sustaining, self-preservation, living, and surviving become analogous. Living systems have the instinctive and innate desire to stay alive. They want to survive and therefore use the strategy or capability to self-organize in a manner that allows them to exist despite the negating input from other systems and their environment. How complex the sustainability mechanism is in a living system depends on the living system's degree of complexity. A human system meets the definition of a living system. It possesses highly intricate and interconnected autopoietic

networks, a dissipative human structure, and sophisticated cognitive process. Human systems are indeed very complex living systems.

One aspect of the human system that is very complex is how it communicates and interacts. From the lens of the Santiago theory of cognition, it explains that the human system cognitively interacts with other human, living, and non-living systems and the environment via language, abstract thinking, symbols and mental representations. "Human thought is always embedded in the bodily sensations and processes that contribute to the full spectrum of cognition."[60] According to the Santiago Theory, human systems communicate not to transmit information but to coordinate behavior among other systems. This idea is analogous to a baby's cry, indicating his hunger, coordinating his parent's response to bring him milk. Languaging is dependent upon the meanings agreed or understood upon by a group of people. It is a linguistic domain in which human beings are able to couple structurally or interact with other systems and their environment.

The Santiago theory of cognition offers more than the description of the link between structure and process, it also makes bold assertions about human beings. The theory provides an explanation why the human system has been a successful living system. It attributes a human system's success to human beings' ability to create their future and to change the status and conditions of their environment. They are able to maintain a sense of their historical past and to choose what they want to learn from the past. Human beings structurally couple with each other and every aspect within the planet earth based on their own choosing. Both the human system and the world co-evolve in a sense they both interact with each other. In doing so, human beings bring

forth a world tomorrow based on the decisions and interactions they make today. One needs to look at past solutions in order to understand problems today.[61] The future and succeeding generation of human beings are determined by the actions taken today. Though human beings have little control over a lot of aspects of the environment and Mother Nature, nevertheless, they are responsible for the co-evolution of both themselves and their environment. The theory clearly recognizes the power of human beings to create their future. It boldly states that the appropriate use of this power will determine the successful and continued survival and existence of the human race. If it does not survive, human beings have no one to blame but themselves. As explained later in the study, the human system directly contributes to the complexity of military systems. The added dimension that human systems bring plays an integral role in understanding the survival of a military system on the verge of annihilation.

This is what makes the theories of living systems and cognition powerfully intriguing. These theories provide a holistic understanding of what living is all about. They are able to confront the complexity of nature and at the same time offer a deeper understanding of human life. Most significantly, they offer a strategy for success in the future and an explanation to failures of today. The strategy they reveal is universally applicable in all disciplines of study and can be used by any living and non-living system.

The term success is relative and defined by the beholder. For a living organism, success is measured from its continued existence of living and survival. In the military realm, there is a different measurement for success. This measurement becomes apparent in the next section.

This section and preceding section established Capra's theory of living systems and Santiago theory of cognition as the foundation for the study's theoretical framework. A living system possesses autopoietic pattern of organization, dissipative structure, and cognitive process. This is the theoretical framework that the next section uses to propose that a military system is a living system. The discussion that follows redefines Capra's criteria for living into military language. It represents a direct application of the unifying and universal theory of living systems within the realm of tactical combat.

SECTION IV: A Living Military System

Through the advantage of conceptual speed man could ensnare the natural world in "mind-forged" traps. He did this in three ways: through anticipation, adaptation, and domination. The military implications of the emergence of the mind thus become evident...the ability to dominate nature meant man could control his fate and dominate his own future.

- James J. Schneider, "How War Works"[62]

This section consists of three parts. The first part briefly reviews the essence of the theory of living systems and Santiago theory of cognition to outline the foundation of the theoretical framework of this study. The second part describes the human system as the most vital element of a military system. Despite the fact a military system relies on the human system for its existence; there are other complex aspects within a military system that make it a living system. These aspects are easier to describe after a discussion of the human system. The last part identifies the criteria of living within the context of a military system. The latter serves to propose that a military system is a living system based on the following framework.

Theoretical Framework:

The summary below reviews the essence of Capra's theory of living systems and the Santiago theory of cognition. The premises, or criteria, established in the preceding

sections make up the theoretical framework of the study. A military system is a living system if it meets the following criteria:

* It possesses an autopoietic pattern of organization, dissipative structures, and cognitive process.

* It possesses the ability to self-organize.

* It is an organizationally closed but thermodynamically open system that allows the flow of energy, information, and matter existing within the system.

* It can operate far from equilibrium while generating new forms of structure and behavior in an ordered manner.

* It has the freedom to decide future behavior as defined by the capabilities of its structure.

* It lives and survives by conserving its living criteria. Living and surviving are synonymous.

* Its cognitive and simultaneous responses serve to achieve two purposes: first, to maintain and sustain its autopoiesis components and processes; and secondly, to structurally couple to the environment.

With these criteria in mind, it is now time to transform them into the language of military combat. In doing so, it generates the irrefutable proposal that a military system is a living system. To begin the proposal, the military system's embedded human system must be discussed for it adds to the overall complexity of the system.

The Human System in a Military System:

The human system is the most vital element of a military system. Without an embedded human system, a military organization fails to exist. A military system exists to engage in war in order to achieve political objectives.[63] As noted theorist Carl von Clausewitz states, "War is an act of human intercourse...it is part of man's social existence."[64] Further, he recognizes that "war is a clash between major human interests and activities."[65] The roots of war lie within the human dimension--greed, fear, honor,

hatred, and interest.[66] And on the battlefield, it is a clash between human beings, military men and women representing their respective nations, who fight to support their nation's interests. These men and women make up the human system essential in a military system.

A military system gains much of its adaptability, flexibility, self-renewing, resiliency, learning, and intelligent attributes from the collective members of the human system. As explained in Section III, a living system's acts of cognition serve to continue its existence. Development of a living system is always associated with learning.[67] How effective and efficient a human system structurally couples with its environment depends on its learning. Learning, as a human system's cognitive by-product, contributes to the development and existence of a military system.

> People learn, not systems. Organizations learn only through individuals who learn. Individual learning does not guarantee organizational learning, but without it no organizational learning occurs. Thus, a military organization is dependent upon people's ability and capacity to learn. Human workers have a limitless and unconstrained capacity to learn and are able to spontaneously generate responses to changing conditions and unexpected inputs.[68]

Organizationally, a military avoids catastrophic failures and misfortunes by learning from past experience, anticipating the future and adapting to the future changes and inputs emitted from other living systems and the environment.[69] It does this through its human system.

Capitalizing on the learning capacity of human beings to foster a climate where initiative, innovation, and creativity are valued and unleashed leads to the achievement of desired outcomes and accomplishment missions. "On the field of fire it is the touch of human nature which gives men [soldiers] courage and enables them to make proper use

of their weapons."[70] Human soldiers and leaders are the foundation of a military's will to win. "Their spirit, initiative, intelligence, discipline, courage, and competence comprise the building blocks" of victory.[71] Past and current U.S. Army Chiefs of Staff recognize the critical role of human beings within a military organization and how they contribute to innovation and creativity to achieve success. As General Eric K. Shinseki, current U.S. Army Chief of Staff, articulates in his 1999 vision for the Army:

> The Army – is People. The magnificence of our moments as an Army will continue to be delivered by our people. They are the engines behind our capabilities, and the soldier remains the centerpiece of our formation. We will continue to attract, train, motivate, and retain the most competent and dedicated people in the Nation to fuel our ability to be persuasive in peace and invincible in war.[72]

General Creighton W. Abrams states,

> The Army is not made up of people; the Army is people…living, breathing, serving human beings. They have needs and interests and desires. They have spirit and will, strengths and abilities. They have weaknesses and faults, and they have means. They are the heart of our preparedness…and this preparedness—as a nation and as an Army—depends upon the spirit of our soldiers. It is the spirit that gives the Army…life. Without it we cannot succeed.[73]

Just like human strengths, the soldiers' weaknesses and faults that General Abrams highlights affect a military system in many ways. They manifest themselves throughout the system often shaping the system's behavior and responses.

Limitations of the human system restrict the types of responses a military system can make. In battle, soldiers face physiological, psychological, and ethical challenges.[74] Their physical fitness and health determines their ability to endure battlefield conditions. The combat stress can gradually degrade soldiers' psychological endurance and agility. Mind over matter provides a powerful source of energy and motivation to survive and to fight. Maintaining a certain level of mental fitness may prevent soldiers from falling

victim to the stresses of war. The chaos of battle often forces soldiers to face ethical dilemmas. When soldiers begin to lose sight of lawful actions, it can negatively affect the military system's effectiveness and efficiency. Unethical behavior is cancerous as it undermines the discipline and morale of the human system. In the fog of war, one can easily loose the understanding of ethics. These limitations require a military system to monitor and regulate, otherwise, the inimical effects of these limitations are devastating to the system's existence.

While technology changes the conduct of war, human nature never changes. "As history records, the military with the most advanced technological capability is not always the victor. The military who quickly learns to manipulate the human dimension of war often times walks away as victors."[75]

The human systems make a military system very complex for they exist at all levels, functions, and components within a military system. It is difficult to explain the complex network and structure of a military system without recognizing the omniscient presence, dynamic influences, and human dimension of human systems.

"All living systems are networks of smaller components and the web of life as a whole is a multi-layered structure of living systems nested within other living systems—networks within networks."[76] As the following section suggests, a military system with its nested human system is an example of a nested and webbed living system. Not only because of its embedded human system but, in many ways it displays characteristics associated with a biological system. Specifically, a military system possesses autopoietic pattern of organization, dissipative structures, and cognitive processes. Hence, a military system is a living system.

The Proposal:

A military system is a living system. It possesses a unique autopoietic pattern of organization, dissipative structure, and cognitive processes. These characteristics as defined by Capra's theory of living system allow a military to have attributes of adaptability, flexibility, self-renewing, resiliency, learning, and intelligence.[77] Through its embedded human system, unique structure, and sustaining processes, a military system potentially has the ability to control its fate and dominate its own future. The following transforms and redefines criteria of a living system within the language and realm of the military.

The Military System's Autopoietic Network

The effectiveness of a military system to achieve the objectives of its political system depends on the timely displacement of its combat power at a strategic place in space. A military system's autopoietic pattern of organization lies in the functional networks whose relationships make up what is called combat power. "Overwhelming combat power is achieved when all combat elements are violently brought to bear quickly, giving the enemy no opportunity to respond with coordinated or effective opposition."[78] Combat power gives a military system the ability to fight. "The combat functions are—intelligence, maneuver, fire support, air defense, mobility/survivability, logistics (or combat service support), and battle command (or command and control)."[79] These functions form the pattern of organization found in all military systems, though in varying degrees of complexity and efficiency, and at all levels of war. They *relate* to the human systems, relying on human intervention for continued functionality and

networking. At the tactical level, these functions are known as the Battlefield Operating Systems, or BOS.

Commanders and battle staffs integrate and coordinate these functions to synchronize battle effects in time, space, and purpose.[80] Each function is a network of processes and systems. Viewed as a whole, the relationships between the BOS functional pattern of networks create the complex abstract map of a tactical military system. "One of the remarkable qualities of complex military systems is that they are spontaneously self-organizing."[81]

The BOS is autopoietic in nature as the components function in the production or transformation of other components in the network. The redundancy of networks; functional interconnections within the BOS; and the links the BOS has with other systems all contribute to the self-making process of both the functional components and the military system as a whole. In the realm of the military, the self-making process a military system conducts contributes to this notion of "existence and effectiveness" of a military system. The BOS continually goes through a self-making process for the purpose of sustaining the military system's existence and effectiveness. Consider the following as some illustrations of the autopoietic nature of a military system. These examples serve to provide the essence of self-boundedness, self-organization, self-generation, and self-perpetuation within a military system.

The infantry, armor, cavalry, and attack helicopter units are the elements that provide the actual physical and lethal force. They are the "maneuver" elements whose employment influences the achievement of relative positional advantage and tactical objectives.[82] Combining the maneuver function with the fire support and air defense

functions add to the lethality of the combat power within a military system. Through its relationship with the other BOS functions, particularly the logistical function, the maneuver elements are able to task organize, rebuild, reconstitute and conduct relief-in-place as many times and in many ways in order to remain effective and contribute to the combat power of a military system, enabling the system to achieve tactical objectives.

The network of the combat service support (CSS) units assist in moving maneuver units and keeping them supplied.[83] Tactical logistics is the enabling function that provides manning and arming of tactical units, fixing and fueling their equipment, moving soldiers' equipment and supplies, and sustaining soldiers and their systems.[84] Consistent re-supply, reconstitution, and replacement operations contribute to the military system's self-making or self-organizing process in order for the system to sustain its existence and effectiveness.

The intelligence function, as one of its enabling self-making contributions, facilitates the flow of information concerning the battlefield environment and the threat. The appropriate employment of combat power in terms of time, space, and purpose relies on accurate and timely battlefield and threat information. In particular, information gained from the intelligence network influences the task organization of the maneuver elements. It also influences the command and control (C2) of the whole tactical military system.

Maturana and Varela's concept of Languaging is particularly applicable and important for human systems to communicate so that actions of a military system are coordinated and synchronized. The functional network of C2 exists and relates to other BOS functions and components in order to create the system's overall coordinated and

synchronized behavior. C2 becomes vitally important during the process when the system is determining what components need to be generated and where they need to be tactically employed.

Dissipative Military Structure

A military system is organizationally closed for it operates within an imposed boundary. The boundary of a division, for example, limits all divisional operations within a designated division area of operations. Despite this organizationally closed attribute, it does not prevent a military system from interacting with its battlefield environment and other systems. How a military system interacts depends on the dissipative nature of its structure.

The structure, or physical embodiment, of the BOS come in may forms and compositions. The tactical pattern of the BOS can be configured into many physical structures. Consider these examples of US Army structures:

* Teams, squads, platoons, detachments, companies, battalions, brigades, divisions, corps, task forces

* Light infantry, mechanized infantry, armored, heavy, rangers, airborne, air assault, special forces

* Specialized structures: military intelligence, combat engineers, ordinance, transportation, infantry, armor, cavalry, aviation, field artillery, quartermaster, civil affairs, psychological operations, administration, air defense, special forces

* A military organization on terrain is bounded by operational boundaries (i.e. corps, division, brigade, battalion areas of operations).

There are other types of structures, and in fact too many to list. Nevertheless, the list provides the various shapes, compositions, and components of military dissipative structures.

The dissipative nature of a military structure operating within a boundary makes it an open system, allowing a free flow of energy, information, and matter. Though a division area of operations restricts its operations within a given area, one can find external echelon above divisional units operating within a division area of operation. A division military system needs external support for its tactical operations.

The BOS function benefits from the "open" nature of the system as it allows for interconnections with other systems that help these BOS functions to exist, remain viable, and remain effective and efficient. The autopoietic networks and openness of the system inherently provides feedback mechanisms and regulation. Feedback and regulation provide the system the information it needs to determine what components and functions require maintenance, repair, and replacement. This self-making and self-organization occurs differently in biological organisms and military systems. To illustrate, consider the following example.

Say a flooded and swollen river mandates that a unit conduct a river crossing with bridging assets. If the enemy has been successful in destroying a unit's bridging assets, the autopoietic network of the BOS would coordinate the replacement or repair of those bridging assets. The logic of self-making and self-organization in organisms would say bridging assets would make itself. Clearly, this is impossible and unrealistic. "There is therefore a distinction between self-organizing military systems and biological systems."[85]

On the other hand, the openness of the system makes it vulnerable to perturbations generated by the battlefield environment, enemy, and other living and non-living systems. The system will rely on its autopoietic ability to respond to inimical

perturbations. (Subsequent discussions will address the circumstances surrounding the system's formation of its responses.) A functioning military system in battle is one whose autopoietic functions and structures are in continual change as it responds to the perturbations of the environment and the enemy. It is an open system operating far from equilibrium.

When a military system is in equilibrium it is combat ineffective or even dead.[86] One strategy a military system uses to ensure it goes through bifurcation is that it remembers its past. After actions, military history, doctrine and lessons learned are examples of tools that help a system know and learn from its past experience. Complementing this past knowledge with new information and technology, an effective military system can go through series of bifurcations and innovatively and spontaneously create new tactical defensive or offensive plans, combined arms structures, indirect or direct lethality and non-lethal combat effects, task organizations, and other forms of combat responses and behavior. In doing so, a system increases its potential to survive **and** to remain effective in achieving tactical objectives. This is one aspect of how a military system is able to maximize its sustainability and guarantee self-preservation.

Whatever the response a military system makes, the response is within the capabilities and limitations of its pattern of organization and dissipative structure. The cognitive process of a military system links its autopoietic networks of functions with its dissipative structure in order to determine the types and forms of response. This is in direct compliance with the Santiago theory of cognition.

A Complex Military Cognitive Process

A military system possesses the cognitive process that directly links both the autopoietic network of the BOS and various tactical structures, combining the two to form the "living" process. This process is highly complex. There are four interconnected dimensions that describe the complexity of a military system's cognition.

First, there is an operational dimension. The purpose of a military system at the tactical level finds its roots in the strategic aim of a political system. In his book, *In Pursuit of Military Excellence*, Shimon Naveh traces the evolution and proves the existence of the operational level of war. From his argument, he describes the strategic aim as the element that "provides the cognitive cement to combine the loose complex of independent formations into a coherent operational unit and the decomposition of that cement will cause these formations to spin away from the common operational context."[87] The operational level of war provides the cognitive level by which the abstract definitions of strategic aims and policies are transformed into mechanical intentions in terms of tactical engagements and battles.[88] There are many ways to arrange tactics, the mechanical dimension of warfare, toward the attainment of operational objectives and strategic aims. Strategic aim, as it too is linked to other systems, constantly changes. Changes in aim coupled with the variety of options for arranging the mechanical dimension of warfare exponentially increase the complexity of a military system.

Uniqueness in purpose is the second dimension. From the realization of operational cognition, the uniqueness of a military system is that its "living" encapsulates the notion of existence; continued existence or survival; generation, sustainment, and

employment of combat power; so that, a military system "lives" to inherently survive and for the purpose of achieving objectives, missions, and strategic aims. In biological organisms, their success in living is measured by their survival and promulgation, being able to prosper through time. Success in military systems is measured in terms of their survival and achievement of objectives. While both share the aspect of survival, their cognitive desire for survival are for two different cognitive purposes—promulgation for organisms and mission accomplishment for military systems.

When a military system structurally couples (interacts) with its battlefield environment and enemy, the act of structural coupling is governed by its strategic aim in addition to its structure. As a function of cognition, there are infinite forms of interactions and ways of living a military system can make. Those interactions and living are very non-linear in nature.

The third dimension of complexity is the human dimension of a military system. At the tactical level, given that the strategic aim is embedded in a military system's cognition, the process is nestled in the decision-making process. This mental process occurs within the structure of the soldier, team, leader, battle staff, and commander and at all levels. As one notices, a military system relies on its embedded human system to perform the process of decision-making. Hence, the study returns to what it previously highlighted. The human frailty, strength, perspectives, attributes, and learning capacity (to name a few) have far reaching influential effects, affecting the totality of a military system, particularly as it decides how the military system should proceed in its development. In addition to making decisions, leaders are relied on to sustain the motivation of their subordinates to both survive and fight for the overall purpose of

accomplishing missions. The leadership dimension has an influential role within the human system, as leaders are responsible for the physical and psychological well being of their soldiers. The decisions they make have a direct relationship to the welfare of their soldiers, effectiveness of the organization, and mission accomplishment.

Case in point. A defending soldier in a foxhole who suddenly decides to stop fighting potentially sets in motion the collapse of his platoon defense. The military system, in this case, has the structure of a platoon and can preempt the collapse by a platoon sergeant's decision to fill in the foxhole with another soldier; to reorient the firing sector of a machine gunner; or to change the defensive position of the platoon. Note the number of possible actions a platoon sergeant can make.

Hence, the decision making of a human system (the platoon sergeant) determines the future of a military system. The structures in which the cognitive process occurs in a military system are through each soldier, leader, and battle staff. Organizationally, one form of cognitive process is known as the military decision-making process (MDMP). This is the process that the battle staff uses to integrate the flow of energy, information, and matter into a cohesive military response encapsulated in a plan. The MDMP helps the decision-making structure called the commander, to decide how the military system will integrate and synchronize components to generate combat power at the right place and time.

Similarly, how a military system structurally couples with its environment and enemy is dependent on the decision makers of the system. And, just as in the case of any living organism, the military system decides what perturbations to respond to and what to respond with. The environment and enemy do not dictate how a military system will

respond. For when the environment and enemy begins to control the response of a military system, that military system becomes predictive. More significantly, the system becomes increasingly vulnerable to being forced toward equilibrium, a state of combat ineffectiveness. "In war, when operations settle down to a stable sate, they become predictable and are vulnerable."[89] However, in military warfare, getting a system toward equilibrium is not simple due to its non-linear nature.

The non-linear dimension of behavior is the fourth dimension. A military system's behavior and response are non-linear in nature. It is non-linear because it comes in many forms and is difficult to predict. The non-linearity of behavior brings to the forefront another unique aspect of a military system. As Maturana and Varela propose, "Languaging" allow human beings to coordinate their behavior. Languaging as a form of structural coupling, a non-linear interaction with other living systems, allows human beings to coordinate their behavior to create a world. [90] Military systems, in addition to human Languaging, communicate with each other through the language of force (use of or threat of force). Military force is a means to compel an enemy to a desired will. The enemy, as a living military system, responds to force in a non-linear and unpredictable manner. General Douglas MacArthur was unable to accurately predict the Chinese intervention in the 1950 Korean War.[91] During the US operation to seize Aidid's clan leaders in Mogadishu, no one in the US Army Task Force Ranger predicted Somali citizens to reconfigure their RPGs allowing them to shoot down US Blackhawk helicopters.[92] The Chinese and Somali's, as an example of opposing military systems, exhibited emergent behavior during times of bifurcations. They illustrate the types of

innovative and creative responses that the cognitive process can direct a military system's autopoietic network and structure to respond.

Thus, the cognitive process of a military system can powerfully shape its future, achieve objectives, and attain victories. As the Santiago theory of cognition defines the mind as a mental process, "the military implications of the emergence of the mind thus become evident...the ability to dominate nature meant man could control his fate and dominate his own future.[93] Through its human system alone, a military system can control its fate and dominate its future.

A military system, as a living system, shares with other living systems a common basic and inherent desire to survive. The sustainability of living systems is a promising source for information that offers a set of explanations to the question of how a military system survives and prospers amidst the most severe and adverse situations. In the next section, the notion of maximizing sustainability is transformed in terms of a military system's survivability and sustained combat effectiveness.

SECTION V: Miracle of Survival and Continued Fighting Against All Odds

But nature, on the contrary, organizes itself, and does so in each species of its organized products—following a single pattern, certainly, as to general features, but nevertheless admitting deviations calculated to secure self-preservation under particular circumstances. We might perhaps come nearer to the description of this impenetrable property if we were to call it analogue of life.

-Immanuel Kant [94]

In comparison, living organisms, living systems, and military systems share the inherent desire for self-preservation—to live. The term "living" encapsulates the notion of surviving and prospering within an environment over time. Living organisms prosper by promulgation. Military systems prosper by sustaining combat effectiveness to

accomplish military missions and objectives.[95] "Living" in organisms and "living" in military systems are analogous.

From this analogous relationship, a living organism's mechanisms for living reveal some applicable strategies for surviving and sustaining combat effectiveness to accomplish missions. Through the understanding of the living theory and Santiago theory of cognition as applied to military systems, three general conceptual mechanisms explain why a military system on the verge of annihilation manages to survive and fight effectively.

It has a self-organizing ability. The self-organizing nature of a military system enables it to respond continuously to change, to sustain itself, and move toward greater complexity and order as needed. The harmonious and efficient relationships between the autopoietic BOS networks, human system, military units, operational boundaries, and military cognitive processes all contribute to a military's self-organizing nature.

It's autopoietic network, dissipative structures, and cognitive processes are not critically dissected or isolated.[96] It is beyond this study to identify the minimum critical quantity of essential elements. But the theory of cognitive processes strongly suggests that the cognitive aspect is what is critical. Somehow, a system's cognition will come up with innovative ways to produce emerging and spontaneous behavior with what network and structure remain at a given time. Without structure, processes cannot occur. Without the network, coordination of actions cannot occur. Living is not dependent upon the quantity but rather the quality of the relationship between these three categories, or living criteria, to sustain the struggle for survival and mission accomplishment.

It is continually operating far from equilibrium. Learning from the past and present and adapting to survive present conditions help keep a military system to sustain continual structural and network changes. A non-equilibrium state describes the continual production processes of each autopoietic component. The intelligence cycle, for example, needs to constantly provide the commander and his battle staff with accurate analysis of the enemy and the battlefield in order for the commander to effectively synchronize combat power. The logistics function needs to move and sustain the force. The battle staff, as part of the cognitive process, needs to anticipate actions a commander needs to take in the future. The outcome of these continual changes and activities that keep a military system in constant bifurcations represents the system's efficiency in anticipating the future. If a military system reaches equilibrium, it has failed to anticipate. It was not able to come up with a set of responses and behavior to maintain control and/or dominate both its environment and its enemy. In other words, catastrophic military failure occur because:

> First, military institutions fail because they fail to learn from past experience. Second, military institutions fail because they fail to anticipate the future. Third, military institutions fail because they fail to adapt to the future. Although militaries may learn from the past, the past can never be undone: there is nothing in the past that can be leveraged. Advantage sought in the present is difficult to achieve simply because military institutions are constrained by the dual tyranny of the budget and the acquisition cycle. The only point of leverage available to the military must therefore lie in the future.[97]

Historical military campaigns provide examples of miraculous military survival. Consider the 1950 Korean War. The two cases, from the Korean War, presented in the following sections illustrate the general concept of survival and sustained combat

effectiveness as outlined above. The following historical summary sets the stage for the two case studies.

On an extremely cold Thanksgiving night in 1950, two armies confronted each other along the Chongchon Valley to the Changjin River Valley (Chosin Reservior) of North Korea. After five months of fighting with the North Korea military who had invaded South Korea on 25 June 1950, the United Nations (UN) forces, consisting of primarily the American military, faced an unexpected enemy--the Chinese Communist Force. "After the victorious Inchon Landing by UN forces, the recapture of Seoul, the crossing of the 38th parallel, and subsequent rapid advance toward the Yalu River and the Manchurian border, the North Korean Army had disintegrated and largely disappeared from the scene as a fighting force."[98] Perceiving a threat to their independence, more than 350,000 Chinese men moved in north of the Chongchon and Changjin River valleys undetected.[99] Commanded under General Douglas MacArthur, UN forces prepared to attack north to complete the defeat of the North Korean forces and to conduct a reconnaissance of the areas north of the 38th parallel. As General MacArthur's "reconnaissance in force," Eighth Army and X Corps received the mission to attack north. In the western sector, Eighth Army's mission was to move north of Chongchon Valley "in general assault in an effort to complete the compression and close the vise."[100] In the eastern sector, X Corps would attack north to seize Mupyong-ni on the Manpojin Huichon road; seize Changjin east of the Chosin Reservoir; control the road leading to Chongjin; and advance north to the Yalu.[101] The assumption at the time was that there would be no Chinese intervention. "During the night of 25 November, the second day of the Eighth Army attack and two days before the X Corps was to launch its own, a surprise Chinese attack" changed everything. In freezing temperatures, snow, cold winds, Eighth Army and X Corps found themselves surrounded by waves of Chinese forces, cutting them off from lines of support and sustainment in the vast desolate and mountainous terrain. Eighth Army and X Corps were surrounded and on the verge of annihilation.

Case Study 1- Escaping the Trap[102]

Subordinated under X Corps, the 1st Marine Division's survival and sustained combat effectiveness in the Chosin Reservoir Campaign of the Korean War illustrates the dynamic and harmonious interaction of a military system's autopoietic network, structure, and cognitive process operating at premium efficiency. One particular subordinate unit, Fox Company, 7th Marine Regiment, demonstrated dynamic self-organization amidst impending destruction by overwhelming Chinese attacks at Toktong Pass, 27 November to 2 December 1950.

"The narrow, steep-sided mountain road from the port of Hungnam and Yudami-ni was the vital life line for both the Marines and Army units closing in on the Yalu. It had to be secured."[103] Fox Company's mission was to secure the main supply route (MSR) by defending from "a small flat-topped rise near the road on the south shoulder of Toktong-San (the highest mountain between Hagaru to the south and Yudam-ni to the north)."[104] The Chinese also recognized the importance of this MSR.

> The Chinese 59th Division was subsequently ordered to cut the MSR between Yudam-ni and Hagaru, thus isolating the Marines and blocking their potential escape route. Obviously, whoever controlled Toktong Pass ruled the road in both directions—north to reinforce, south to retreat.[105]

From 27 November to 1 December 1950, in the heart of darkness, elements of the Chinese 59th Division fiercely attacked Fox Company. Miraculously, Fox Company, commanded by Captain William Barber survived three nights of attacks. Killing well over three company-sized enemy forces, the 240-man reinforced Marine infantry company was reduced by twenty-five dead, fifty-four wounded, and decreasing resources of equipment and supplies. After the second night of attack, Fox Company was given the opportunity to withdraw back to Hagaru. Withdrawal meant isolating forward Marines elements north of the defense, depriving them of sustaining lines of communications and a secured roadway. It also meant walking back and there was no way fifty-four wounded Marines could withstand the march in freezing temperatures and rugged terrain. Amazingly, Captain Barber decided to remain in place and to continue the defense of the MSR. "This decision determined the fate of more than 10,000 Marines trapped on the west side of the Chosin Reservior."[106] In return the 1st Marine Division sent a battalion-size element to reinforce and replace Fox Company allowing the company to move to

Hagaru and Hungnam for evacuation under protection. Fox Company survived and sustained enough combat effectiveness to secure the Toktong Pass.

Fox Company comprised of 240 officers and men and augmented by heavy machine guns and 81mm mortar sections.[107] It was structurally organized in three platoons, headquarters, mortar section (60mm and 81mm mortars), and medical team. Captain Barber took every advantage of the terrain and established a 270-degree defense that successfully endured waves of Chinese attacks. With each Chinese penetration, the Marines with their weapons, moved within the defense, covering vulnerable and weakening points on the defense.[108]

The autopoietic network of the company and its higher element provided crucial and vital reinforcing air and artillery fires and re-supply of ammunition, food, blankets, and medical material.[109] Combat power and effectiveness as well as sustaining treatment of the wounded allowed the company to self-organize while receiving the inimical perturbations of freezing temperatures, torrential terrain, and a seemingly overwhelming enemy military system. Fortunately, the company's link with the 7th Marines was never severed. As such, the 7th Marines' decision to send the 1st Battalion, 7th Marines south to attack the rear of the Chinese attacking Fox Company, facilitated the rescue, reinforcement and relief in place of Fox Company.[110]

The human dimension of Fox Company played a critical role in demonstrating efficient and effective cognitive processes. Medical corpsmen "performed miracles with only morphine and field dressings," warming morphine Syrettes in their mouths, kept men from freezing, and provided all important moral support" to the wounded.[111] The Marines learned more about their enemy each day. For example, they learned to blow

"captured Chinese whistles and bugles to confuse the maneuvers of the assaulting Chinese troops." They learned and fought together. The nature of the fighting Marines of Fox Company proved the dictum that a fighting man fights for his fellows primarily and by his weapons secondarily.[112] Each Marines' actions and initiatives represent the cognitive process; all processes were focused by the desire to fight and to achieve the organization's cognitive objectives. They fought heroically.

The leadership of Captain Barber and his key leaders kept their Marines tightly bonded by the desires to survive and to fight. In particular was Captain Barber's effective commandership. Captain Barber, a veteran of World War II and a recipient of the Silver Star and Purple Heart, was a courageous leader who demonstrated great battle command.[113] "The test of fitness to command is the ability to think clearly in the face of unexpected contingency or opportunity. Improvisation is of the essence of initiative in all combat just as initiative is the outward showing of the power of decision."[114] He directed the restructuring of his company defense to repulse Chinese attacks. After the first night of attack, he requested and received air strikes on Chinese snipers positions. Unable to control the fires with his radios, which were incompatible with the aircraft radios, he improvised the link by establishing a "radio relay with his parent regiment at Hagaru and brought eight Australian P-51s on target. The sniper fire ceased."[115] Realizing the decreasing supply of weapons and ammunition, he directed his men to collect Chinese weapons and ammunition to use against their enemy. Captain Barber continually conducted patrols to gain information about the areas beyond his lines and his enemy.[116] He kept a continuous flow of supplies, information, and material, keeping his unit viable, thinking, and operating far from the equilibrium state of ineffectiveness. Shot twice and

had to command from a stretcher during the third day of battle, Captain Barber inspired his Marines to survive and to fight without giving up. His leadership and will to fight were exemplary. Captain Barber passed the test of command at Toktong Pass and his actions earned him a Congressional Medal of Honor.

The defense of Toktong Pass was an illustrative example of how a group of courageous men dominated their enemy and Mother Nature even when all odds were against them. It fully illustrated the mechanisms and processes for survival and sustainability of combat effectiveness in a living military system.

> It is [was] a story that any army could be proud of, and it teaches the valuable military lesson that most American soldiers sorely need to know, and often did not practice in the Korean War—a numerically inferior force can hold out in a tight and well-chosen perimeter defense against a superior force if it does not panic, fights courageously, and has air and artillery support.[117]

Case Study 2- Disintegration

In his book, *The River and The Gauntlet*, Samuel L.A. Marshall describes in detail from the small level tactics how the process of disintegration began from a series of perturbations initiated by the enemy and snowballed into the historic mass and chaotic withdrawal of the Eighth Army. [118] By adding up all the details Marshall provides into an overall collage, Eighth Army's circular causality of defeat is created. The disintegration represents the collapse of the battlefield operating functions and human system; a dissipative structure forced toward a state of equilibrium; and paralyzed cognitive decision-making processes. These three criteria were the recurring themes throughout Marshall's book.

Marshall concludes, the Chinese "became victors on the field of the Chongchon because they had a decisive superiority in information."[119] The Chinese exploited the intelligence they received to enable them to isolate the Eighth Army's survival and sustained combat effectiveness mechanisms and processes. The "principal source of information about MacArthur's forces and movements was the intercepted dispatches of the war correspondents, which speaks highly of the accuracy of the reporting but does not say much for the security of the military."[120] The American belief that the Chinese were "far too much concerned with the enormous domestic problems their government faced in the rebuilding of a shattered Chinese economy" gave the element of surprise and masked any Chinese military actions.[121] Through their intercepts the Chinese monitored the success of their undetected infiltration and the level of surprise of their operation. North Korean and Chinese agents freely moved in and out of South Korea.[122] With each return, these agents reported the status, disposition, and locations of Eighth Army forces in the Chongchon Valley. Chinese men joined into the North Korean forces under the ruse of "volunteers," and UN troops were unable to discern whom they were actually fighting. Eighth Army began fighting the Chinese as early as October and they did not know it. The leaders and battle staff of Eighth Army suffered from cognitive dissonance. Though reports from units indicated capture of Chinese prisoners of war (POW), no one could see the inaccuracy of the unlikelihood of Chinese intervention. Armed with accurate information, the Chinese built an abstract map of the vulnerabilities and weak points of the UN troops setting. They leveraged these points to isolate simultaneously the battlefield operating networks, structural responses, and decision-making process from each other and achieved the collapse of the Eighth Army.

"The enemy [Chinese] blow had landed with full speed, full surprise, and full shock. There is no need to speculate that some paralysis of thought derived from it." The Chinese were more than happy to take advantage of every tactical mistake made by the units of the Eighth Army. Maneuver elements moved beyond the range of supporting artillery fires. And even when there was fire support, artillery landings were inaccurate. There were gaping holes between companies and battalions, gaps uncovered by cross fires. Leaders were reluctant or did not show the initiative to patrol the areas around their bases or to recon areas they were planning to bivouac. Units carried insufficient amounts of supplies, ammunition, and equipment to sustain themselves. Forward movement of units stretched the lines of communications such that the logistics effort was unable to respond quickly. When the Chinese attacked with full speed, full surprise, and full shock, it created a devastating collapse.[123] "The physical damage to communications in the American sector was such as to prevent any immediate and accurate reckoning of the magnitude of the assault and of the wreckage."[124]

With no communications, no lifelines, insufficient energy in terms of supplies, and lack of accurate information about the enemy, soldiers of the Eighth Army lost their control of their emotions, fears, and cognition. "Control is a man-to-man force on the battlefield. No matter how lowly his rank, any man who controls himself automatically contributes to the control of others. Fear is contagious but courage is not less so."[125] Soldiers and leaders were unable to let their cognitive intuition and judgment to pull their units together. Even if there was one with a calm frame of mind, he was outnumbered by infantrymen whose minds were "gripped with fear."[126] Paralysis comes from varying fears; men afraid want to do nothing. "As a body they had panicked, some running for

the hills and others fleeing south."[127] Upon seeing the flight others joined, learning "firsthand that panic is contagious."[128] The self-organizing attribute of the Eighth Army ceased to exist. They could not even respond just to staying alive. The Chinese forced them into predictive responses and led them toward an equilibrium state of combat ineffectiveness.

The Eighth Army response could not adapt to an enemy they did not expect to fight against. The devastating blow of Chinese assaults forced the Eighth Army to restrict the effects of their response to maintaining the existence of its battlefield operating systems of functional network for the only purpose of surviving. However, the human system, the leaders and soldiers, failed to provide appropriate and dynamic cognitive decision-making as vast numbers focused on their fears. They stopped thinking and reacted, some ran away to join others who were running away instead of fighting. The Chinese's dominance over information allowed them to predict and shape the battles. They had full situational awareness and mastery of the terrain as Eighth Army walked into a lion's den.

After these severe bifurcations, fortunately, the Eighth Army consolidated and self-organized. Though they lost hard fought terrain north of the 38th parallel, their temporary defeat in those cold murderous nights in November 1950 became a source of renewed energy throughout the Korean War. As Lieutenant General Arthur G. Trudeau writes in Marshall's *The River and The Gauntlet*:

> In any human system, there will always be some who cannot live up to the ideal code, but if renewed proof had been needed that the American soldier in Korea had lost none of the courage and resiliency born in the despairing days of Valley Forge, this narrative supplies irrefutable evidence. Units, which were virtually wrecked by the overwhelming weight and force of the Chinese intervention, were solid organizations

> short weeks later. Americans do not like being knocked down, and they have a characteristic which these men of Korea readily displayed—of getting up wiser, tougher, rougher and more determined.[129]

One author concludes that the permanent lesson that the Americans failed to use in Vietnam is: "It is no good going to war against an indigenous population fighting for its life, because the intelligence factor is all on the side of the native army. And make no mistake, the Chinese and their North Korean allies knew that if they lost this war they would lose their independence."[130] And so, the Chinese developed a cunning military operation against a highly technologically advanced and powerful American force. Despite their inferior capabilities, they managed to expel their enemy far from the Yalu River and down to the 38th parallel.

It was as if they knew how to suck the life of the Eighth Army and X Corps. It was as if the Chinese back then planned against a living military system. Viewing the enemy as a living system is a different and new perspective. There is a significant utility in viewing from this perspective. The following section elaborates on this very notion.

SECTION VI: Planning Against A Living Enemy System

Generally in war the best policy is to take a state intact; to ruin it is inferior to this. To capture the enemy's army is better than to destroy it; to take intact a battalion, a company or a five-man squad is better than to destroy them. For to win one hundred victories in one hundred battles is not the acme of skill. To subdue the enemy without fighting is the acme of skill. Thus, what is of supreme importance in war is to attack the enemy's strategy.

- Sun Tzu [131]

A military system is a living system for it possesses the living attributes and can potentially dominate nature and its future. The living components of a living system analogously describe in general concept the survival and sustained combat effectiveness of a military system. In light of the evidence and examples presented in the preceding

sections, the study brings forth a profound perspective that all military planners should take notice.

Viewing the enemy as a living system offers another set of lenses through which to see the vulnerabilities of the enemy. For example, the application of the theory of living systems and Santiago theory reveal in conceptual form how a system survives and sustains combat effectiveness. Knowing this one can select specific and lucrative targets by which to apply combat power to produce desired effects. Some desired effects are as follows:

* Isolate or disrupt the functional networks, military structures, and cognitive decision-making elements of an enemy system that enables *living*.

* Destroy or dominate an enemy system's ability to self-organize.

* Force the enemy system to operate toward equilibrium, making his responses predictive, reactive, and limited in number. (For example: Take advantage of the enemy system's nature of openness by infiltration of spies, double agent operations, computer virus, subversion, faulty information insertion, and other things that gain control and dominance of the system.)

There are other possible combinations of lethal and non-lethal actions that can be applied to control and dominate an enemy system's components. The possibilities are infinite.

From the lens of living systems, there are gaps and shortfalls in current U.S. Army operational doctrine. The intelligence preparation of the battlefield framework described in FM 34-130 *Intelligence Preparation of the Battlefield* (8 July 1994) comprehensively provides a systems approach. The framework takes into full account the relationships between the battlefield environment, the enemy, and our military system. However, it fails to recognize fully the enemy's self-organizing attributes as a living military system.

In the intelligence preparation of the battlefield (IPB) the acronym METT-TC (mission, enemy, time, terrain, troops and civil considerations) represents varying elements that should be considered to help analyze the known facts and identify the unknowns. Within this acronym, the element that offers the most non-predictive, complex, and non-linear factors is the enemy.

The enemy is the most elusive and unpredictable. The major reason is the human systems within the enemy military system. Its frame of mind and mental processes are governed by its unique culture and society. How the enemy directs its own functional networks and structural couplings are different than that of an American military system. As the study suggests, the self-organizing ability of a living enemy military system is heavily influenced by its human system.

Difficulty in deducing a set of courses of action (COAs) is due to the cognitive processes of the enemy. Military analysis focuses its effort on generating the most likely and dangerous courses of action that an enemy can potentially take. But as soon as the first round is fired on the battlefield, the enemy more than likely will not react as described in one of the COAs deduced. Hence, the cliché, "fight the enemy not the plan," has a lot of truism. The enemy's responses to the perturbations our military provides may or may not be able to generate our desired response.

The nature of the emerging spontaneous behavior of a living enemy system strongly emphasizes a need to analyze how to get the enemy to operate in equilibrium; to affect the enemy's self-organizing ability; to influence the enemy's cognitive processes; and to isolate the enemy's functional networks from its structural responses. Intelligence efforts do well in identifying weaknesses, strengths, and capabilities of the enemy but do

little in analyzing the cognitive aspect of the enemy. Current US Army intelligence doctrinal manuals like FM 34-3 *Intelligence Analysis* (15 March 1990) and FM 34-130 *Intelligence Preparation of the Battlefield* (8 July 1994) do not recognize and account for the ramification of a self-organizing and living enemy system.

Case in point: The formulation of the commander's priority of intelligence requirement (PIR) looses its value with every execution of a selected COA. Current doctrine stipulates that PIR is strictly tied to a commander's decisions. These decisions may or may not be associated with an execution of a COA. If it is, the corresponding PIR is supposed to tell a commander when a specific enemy set or condition occurs to trigger him to order the execution of that COA. Given the freedom and wide range of responses an enemy has, that corresponding PIR is more often remains unanswered because the enemy did something else in response to a commander's previous actions, actions executed before that COA. This is perhaps a shortfall in our intelligence doctrine.

The study calls for a deeper view of the enemy, more than a systems view as Warden's five-ring model of an enemy system. The five-ring model proposes the enemy is made up of five fundamental systems, each with a level of importance (listed in order): leadership, organic essentials, infrastructure, population, and fielded military. Along the same lines as the theory of cognition suggests the five-ring model identifies the leadership as the most important ring for it provides the cognitive energy and direction to orchestrate the efforts of the other rings. It implies that the leaders of the nation must be protected by the other rings to preserve the sovereignty of the nation. Strategic war is "to force the enemy state or organization to do what you want it to do."[132] "It is, however, the whole system that is our [the] target, not its military forces."[133] The model delineates

its focus at the strategic level of war and separates the military system from the whole "enemy." The logic of this concentric model falls apart as it falls victim to the trap of a mechanistic argument.

Again, the model fails to recognize the self-organizing ability of an enemy. The ability to self-organize exists at all levels of war. The enemy, as a living system, has the means and resources that make up its autopoietic networks, dissipative structures, and cognitive processes. Though the model recognizes the role of the human system, it restricts its role solely in the leadership ring. On the contrary, human systems exist in organic essentials, infrastructure, population, and fielded military rings in unique ways. This failure in recognition also highlights the flaw in the linear equation of:

Physical x Moral = Outcome.

Airpower, as the model strongly states, does not directly apply force in the moral domain. To Warden, the moral aspect of the enemy cannot be physically destroyed. Only those physical entities of an enemy system can be physically destroyed by airpower. As a strategic weapon, airpower is able to physically attack right into the leadership ring. For it is the leadership that ultimately must be convinced to accept our objectives. There are two fundamental flaws with this logic. First, if the leadership is decapitated, who is left to negotiate with? Do we then take over in governing our enemy's nation? Secondly, the logic totally disregards the self-organizing and influential response of the population and the fielded military, both of which could become a source for overwhelming energy and power. Yes, both can be physically attacked, too. However, their non-linear aspect can spontaneously produce emerging new responses that can potentially negate even the most destructive and accurate physical attacks of airpower.

Killed leaders often become martyrs to their own suppressed people. Sometimes the very people being rescued from the oppression of their leader become the enemy.

The dissipative nature of the enemy structure is such that it is susceptible to indirect, direct, non-lethal, and lethal forms of force. The five-ring model does not recognize the debilitating effects of targeting the moral or the cognitive process of an enemy using these forms of force. Information operations, psychological operations, electronic warfare, operations security, double agent operations, counterintelligence, espionage, and reconnaissance efforts could have influential effects against the moral and cognitive process of the enemy such that physical attack is unnecessary.[134] Such efforts have the potential to result in cybernetic paralysis that forces an enemy into a broad state of panic and temporary ineffectiveness.[135] "The simple fact remains that military systems are rarely destroyed by paralysis alone."[136] Military systems are difficult to physically destroyed in total. They are, however, highly vulnerable to disruption. Again, the self-organizing nature of enemy systems can kick in at any time depending on the remaining autopoietic networks and dissipative structures. Nevertheless, the effective affects applied against the cognitive process of a system can bring about a desired outcome.

The understanding of the theory of living systems and the Santiago theory of cognition questions the validity of the five-ring model. While all share the foundation of systems thinking, the model fatally disregards the living aspects of an enemy. In refuting the validity of the five-ring model and evaluating current US Army doctrine, the insights of the theories used in this study are emphasized to reveal the importance and profound utility of viewing the enemy as a living system. They are insights that provide military planners a set of considerations as they contemplate and design a military operation

targeted against a living enemy system. More importantly, these theories strongly recommend that military planners make a shift of mind.

SECTION VII: Conclusions

...a shift of mind from seeing parts to seeing wholes, from seeing people as helpless reactors to seeing them as active participants in shaping their reality, from reacting to the present to creating the future.

- Peter M. Senge, The Fifth Discipline [137]

The shift of mind that Senge describes in *The Fifth of Discipline* is viewing the world through systems thinking- a view of seeing the wholes instead of the parts alone. In light of the study, three conclusions come to the fore to suggest strongly a deeper shift of mind. Still within the confines of systems thinking, the deeper viewpoint is seeing the world as a ***living*** system.

Capra's theory of living systems and the Santiago theory of cognition is another fundamental perspective by which to understand the world of living. Applying these theories in the realm of combat reveals tactical military systems are living systems because they possess three criteria for living: 1) autopoietic and self-organizing BOS networks, structures, and a human system; 2) an innate and inherent attribute of being an organizationally closed but open system; and 3) dynamic multi-leveled cognitive decision-making processes. These three criteria are all analogous to the living criteria of: autopoietic patterns of organization, dissipative structure, and cognitive process.

Secondly, the self-preservation mechanisms and processes discovered in living organisms exist to facilitate survival and promulgation. This is how the theories narrowly define the term ***living*** for a living organism. ***Living*** for a tactical military system also has the innate aspect of self-preservation or survival. However, a military system's need to

survive complements its purpose to accomplish objectives and missions. Nevertheless, the commonality of self-preservation between two different systems provides a general conceptual model of the surviving and sustaining combat effectiveness mechanisms and processes for a military unit on the verge of annihilation. The self-organizing ability as facilitated by its three living criteria, allow a military unit facing overwhelming odds to spontaneously emerge new forms of behavior and temporary structures and thereby, manage to survive and fight effectively.

The significance of these two conclusions is that it provides a planning framework that has great utility in designing military operations. The third conclusion of this study calls for another deeper shift in view. Viewing the enemy as a living military system offers a new perspective never before seen. While Warden's five-ring model accurately supports the systems view of the enemy, the model fails to recognize the autopoietic networks and self-organizing aspects of an enemy system. In fact, the enemy at any level of war is a living system.

Perhaps the first step toward attaining, what Sun Tzu called, the "acme of skill"—the skill to subdue the enemy without fighting, is to begin viewing the enemy as a living system. After all, the world and the enemy are not clocklike machines, they are living systems.

Recommendation for Further Study

There are a host of studies, in progress and completed, focused on applying the insights and principles of both the theory of living systems and Santiago theory of cognition in the field of business, human resources, leadership management and organizational development and effectiveness. However, there is very little research

done in regard to applying this emerging understanding to military warfare, particularly in military organizational effectiveness. Here are some ideas to consider:

* Discovering strategies and developing technical designs of equipment to transform military organizations toward functioning more like a living system.

* How should the doctrine for IPB, MDMP, and intelligence operations change to account for the living aspects of an enemy system?

* Develop feedback mechanisms and regulations that facilitate the cognitive process within a military organization to operate dynamically and spontaneously.

[1] S.L.A. Marshall, *Men Against Fire: The Problem of Battle Command in Future War* (Gloucester, MA: Peter Smith, 1978), p. 184.

[2] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962), p. 92. Kuhn explains new incompatible paradigm replaces older paradigm through developmental episodes that he describes as scientific revolutions.

[3] Ibid.

[4] Fritjof Capra, *The Web of Life: A New Scientific Understanding of Living Systems* (New York: Anchor Books Doubleday, 1997), p. 5.

[5] Margaret J. Wheately and Myron Kellner-Rogers, "Self-Organization: The Irresistible Future Organizing," [Available online: http://www.sirius.com/~kaos3/Self-Organizing.html, 8 December 1999]

[6] Ibid.

[7] Kuhn, p. 52.

[8] Ibid.

[9] According to Capra, Descartes created the analytical method of "breaking up complex phenomena into pieces to understand the behavior of the whole from the properties of its parts." Descartes viewed a living organism as a machine and therefore believed in creating an understanding by analyzing the organism's smallest parts. See Capra, p. 19.

[10] Capra, p. 20.

[11] Ibid.

[12] Carl J. Friedrich, *The Philosophy of Kant: Immanuel Kant's Moral and Political Writings* (New York: The Modern Library, 1993), pp. xvii and xxvi. Friedrich describes Kant as "a systematic philosophy par excellence." Kant is known to approach phenomena using a metaphysical framework. As Freidrich states, "Kant proposes that the modern method be employed in metaphysics. However, metaphysics is concerned with another set of data. Its realm is inner experience as contrasted with the outer experience of the natural sciences. Metaphysics is nevertheless concerned with something very real, because these inner experiences are real to just as great an extent as the outer ones."

[13] Ibid., pp. 345-350. On p. 348, Kant states, "On the contrary the part must be an organ producing the other parts—each, consequently reciprocally producing the others...Only under these conditions and upon these terms can such a product be an organized and self-organized being, and, as such, be called a natural end." Capra interprets and uses this statement to highlight Kant's view that nature does not exist like a machine. See also Capra, pp. 21-22.

[14] Capra, p. 25.

[15] According to Capra, Christian von Ehrenfels, a philosopher, coined the phrase "the whole is more than the sum of its parts." This became the basis of all systems thinking approach. See Capra, p. 31.

[16] Friedrich, p. 348. Kant states, "An organized being is, therefore, not a mere machine. For a machine has solely motive power, whereas an organized being possesses inherent formative power, and such, moreover, as it can impart to material devoid of it—material which it organizes. This, therefore, is a self-propagating formative power, which cannot be explained by the capacity of movement alone, that is to say, by mechanism."

[17] Capra, p. 27.

[18] Ludwig von Bertalanffy, *General System Theory: Foundations, Development, Applications* (New York: George Braziller, 1968), p. 33. Author defines the term system as "complexes of elements standing in interaction." This definition is consistently used within the scientific community. See also, Capra, p. 29.

[19] Capra, pp. 27-29.

[20] Ibid., On p. 27, author states these two aspects are "subsequently unified in the concept of pattern as a configuration of ordered relationships."

[21] Friedrich, p. 348. See also Capra, p. 22.

[22] M. Mitchell Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Simon and Schuster, 1992), p. 65.

[23] Friedrich, p. 349.

[24] Bertalanffy, pp. 120-184; Capra, pp. 83-85; and Mark D. Youngblood, *Life at the Edge of Chaos: Creating the Quantum Organization* (Dallas: Perceval Publishing, 1997), p. 34.

[25] Bertalanffy, pp. 32 and 120-122.

[26] Capra, pp. 102-103.

[27] Ibid., pp. 185-193.

[28] Ibid., p. 183.

[29] Ibid., p. 160.

[30] Ibid. The applicable theories Capra bases his understanding are those of Maturana and Varela's theory of autopoiesis (as the pattern of life); Prigogine's dissipative structure as the structure of living systems; and Bateson, Maturana, and Varela's definition of cognition as the process of life.

[31] Youngblood, p. 285.

[32] This is Dr. James J. Schneider's editorial statement that he provided during his initial review of the study. The statement directly pinpoints the utility of the theory of living systems into the realm of combat military actions.

[33] Capra, p. 158. In Dr. Humberto Maturana and Francisco Varela's *Tree of Knowledge* (Boston: Shambhala, 1998), p. 47, they define organization as, it "denotes those relations that must exist among the components of a system for it to be a member of a specific class. Structure denotes the components and relations that actually constitute a particular unity and make its organization real."

[34] Capra, p. 162. See also Maturana and Varela, p.42-49.

[35] Maturana and Varela, p. 47.

[36] Capra, p. 208.

[37] Ibid., p. 167.

[38] Bertalanffy, pp. 156-160 and Capra, p. 167.

[39] Capra, p. 162.

[40] This is a generalized definition offered by Dr. Schneider during his initial review of the study.

[41] Capra, p. 158.

[42] Youngblood, pp. 35-36.

[43] Bertalanffy, p. 191. Author states, "Biologically, life is not maintenance or restoration of equilibrium but is essentially maintenance of disequilibria, as the doctrine of the organism as open system reveals. Reaching equilibrium means death and consequent decay."

[44] Capra, p. 190.

[45] Ibid., p. 85.

[46] Ibid., p. 191. Based on their biological study, Maturana and Varela, define historical beings as that of beings who have conserved set of traits which have been passed on from one generation to another. On p. 57, *The Tree of Knowledge*, they state, "Each time in a system that a state arises as a modification of a previous state, we have a historical phenomenon. In the case of living beings, the original unity is a living being, an autopoietic unit; and the process must end with the formation of at least one other autopoietic unity distinct from what is considered to be the first." On p. 103, they continue to suggest, "an individual history of structural change is a structural drift that occurs with conservation of organization and adaptation...conservation of autopoiesis and conservation of adaptation are necessary conditions for the existence of living beings."

[47] Ibid., p. 172.

[48] Ibid., p. 267.

[49] The Santiago Theory of Cognition was developed through the study of biological and neural systems. Dr. Humberto Maturana is a Chilean Biologist who began his scientific exploration in viewing living systems as entities who directed their own processes in 1960. He teamed up with his student, Dr. Francisco Varela, in 1970 and collaborated on an exploration of cognitive processes in biological organisms. As a result, they discovered a biological phenomenology and published "the book, *Autopoiesis: The Organization of the Living* in 1973." They continue their exploration in the field of cognitive science in separate and distant places. See, Maturana and Varela, *The Tree of Knowledge*, pp. 12-13.

[50] Maturana and Varela, p. 241.

[51] Capra, pp. 173-174.

[52] Ibid., p. 175 and Maturana and Varela, p. 29. Maturana and Varela explain cognition as an effective action, "an action that will enable a living being to continue its existence in a definite environment as it brings fort its world."

[53] Maturana and Varela, pp. 75-80 and Capra, p. 267. Maturana and Varela define structural coupling as a process where "a history of recurrent interactions lead to the structural congruence between two (or more) systems."

[54] Maturana and Varela, pp. 26-27. Authors explain that in "every act of knowing brings forth a world." "All doing is knowing, and all knowing is doing. It is very important not to forget that circularity between action and experience applies also to what we are doing here and now. Every reflection brings forth a world." They suggest "where we came from and where we are going" constitute the act of knowing. "Bring forth a world is the burning issue of knowledge. It is associated with the deepest roots of our

cognitive being, however strong our experience may be. And because these roots go to the very biologic base—as we shall see—this bring forth of a world manifests itself in all our actions and all our being. Certainly, it manifests itself in all those actions of human social life where it is often evident, as in the case of values and preferences."

[55] Capra, p. 268.

[56] Maturana and Varela, pp. 29-30.

[57] Capra, pp. 210-211.

[58] Bertalanffy, p. 117. In proposing a comprehensive and encompassing general system theory to understand the phenomenon of life and nature, Bertalanffy, too, recognizes the differences between organisms and human beings. Bertanlanffy carefully develops his systems theory without reducing human systems to biological systems. This is evident when he writes on p. 117, "Nobody should know better than the biologist that civilizations are not "organisms." It is trivial to the extreme that a biological organism, a material entity and unity in space and time, is something different from a social group consisting of distinct individuals, and even more from a civilization consisting of generations of human beings, of material products, institutions, ideas, values, and what not." He uses relevant and applicable aspects of the biology of organisms to assist in understanding the dynamics of human systems. This study is appropriately constrained by the notion that human systems are not biological systems. It also complies with Dr. James Schneider's (monograph director) assessment that human systems are fundamentally goal/end oriented while biological systems may not be.

[59] Capra, p. 298.

[60] Ibid., p. 275.

[61] Peter M. Senge, *The Fifth Discipline: The Art and Practice of The Learning Organization* (New York: Currency Doubleday, 1990), pp. 57-58.

[62] James J. Schneider, "How War Works: The Origins, Nature, and Purpose of Military Theory," *Military Theory Readings* (Fort Leavenworth: U.S. Army Command and General Staff College, Academic Year 1999-2000), p. 5.

[63] Carl von Clausewitz, On War, Edited and translated by Michael Howard and Peter Paret (New York: Everyman's Library, Alfred A. Knopf, 1993), pp. 99 and 731-739. Author writes, "War is a continuation of policy." This enduring statement recognizes the very reason nations go to war is to pursue respective national interests through the use or threat of military force.

[64] Clausewitz, p. 173.

[65] Ibid.

[66] Robert B. Strassler, *The Landmark Thucydides: A Comprehensive Guide to the Peloponnesian War* (New York: The Free Press, 1996), p. 43. Thucydides' underlying theme in his chronicle of the Peloponnesian War is that mankind go to war due to "fear, honor, and interest." This is a dictum that validates itself through each successive war and human conflict.

[67] Capra, p. 268.

[68] Madelfia A. Abb, "Bringing About a Military Learning Organization: US Army in the Philippine War, 1899-1902," (School of Advanced Military Studies (SAMS), Advanced Military Studies Program monograph, AY 1999-2000, U.S. Army Command and General Staff College (USACGSC), Fort Leavenworth, Kansas), pp. 7-8.

[69] Eliot Cohen and John Gooch, *Military Misfortunes* (New York: The Free Press, 1990), pp. 5-58. Authors identify three basic kinds of failure: failure to learn, failure to anticipate, and failure to adapt. They use this framework to analyze costly military misfortunes or failures. In James J. Schneider's "What If We Fight Tonight," SAMS AMSP *Military Theory Readings*, Academic Year 1999-2000 (Fort Leavenworth: USACGSC), he summarizes the importance for military planners to look in the past for lessons in order to accurately shape the future. He states, "The importance of the role of the mind in leveraging the future concerns the very nature of that future."

[70] Marshall, *Men Against Fire*, p. 41.

[71] Field Manual (FM) 100-5, *Operations* (Headquarters, Department of the Army, 1993), p. 14-1.

[72] Eric K. Shinseki, General, U.S. Army Chief of Staff, "The Army Vision: Soldiers on Point for the Nation...Persuasive in Peace, Invincible in War."
[Available online: http://www.hqda.army.mil/ocsa/vision.htm, 30 November 1999]

[73] FM 22-100, *Army Leadership* (Headquarters, Department of the Army, August 1999), p. 3-1.

[74] FM 100-5, p. 14-1.

[75] Abb, p. 13.

[76] Capra, p. 209.

[77] Wheately and Myron Kellner-Rogers, "Self-Organization: The Irresistible Future Organizing."

[78] FM 100-5, p. 2-9.

[79] Ibid., p. 2-12.

[80] FM 71-100, *Division Operations* (Headquarters, Department of the Army, June 1996), p. 2-18.

[81] James J. Schneider, "Black Lights: Chaos, Complexity and the Promise of Information Warfare," *Military Theory Readings*, AMSP, SAMS, (Fort Leavenworth: USACGSC, AY 1999-2000), p. 13.

[82] FM 100-5, p. 2-13; FM 71-100, pp. 1-8 to 1-14; and FM 100-15, *Corps Operations* (Headquarters, Department of the Army, October 1996), pp. 2-11 to 2-14.

[83] Martin Van Creveld, *Supplying War: Logistics from Wallenstein to Patton* (Cambridge: Cambridge University Press, 1977), p. 1. Author defines logistics as "the practical art of moving armies and keeping them supplied."

[84] Student Text (ST) 63-1, *Division and Corps Logistics* (USACGSC, Fort Leavenworth, Kansas, 1 July 1999), p. 1-1. In FM 100-5, p. 12-3, manual adds, "Operational logistics focuses on force reception, infrastructure development, distribution, and the management of materiel, movements, personnel, and health services. Operational logistics encompasses those support activities required to sustain campaigns and major operations. It enables success at the tactical level of war. Tactical logistics, which includes construction-engineering activities, sustains the tactical commander's ability to fight battles and engagements. Successful tactical logistics provide the right support at the right time and place to units in the communication zone. The focus at the tactical level is on manning and arming tactical units, fixing and fueling their equipment, moving soldiers, equipment, and supplies, and sustaining soldiers and their systems." Logistics must have the characteristics of anticipation, integration, continuity, responsiveness, and improvisation.

[85] Schneider, "Black Lights," p. 14.

[86] Linda P. Beckerman's "The Non-Linear Dynamics of War" [Available online: http://www.belisarius.com/modern_business_strategy/beckerman/non_linear.htm, 6 January 2000], p.5, provides an excellent application of the concepts of open systems operating from equilibrium; bifurcation; perturbations; structural coupling; and other concepts presented in this study to military warfare.

[87] Shimon Naveh, *In Pursuit of Military Excellence: The Evolution of Operational Theory* (London: Frank Cass, 1997), p. 16. The cognitive aim that Naveh refers to is analogous to the "hive mind" concept Kevin Kelly uses in his book to describe an intangible and non-physical directing force that gives focus to a collaborative behavior. Kelly defines "hive mind" as "an invisible hand" governing the control of a community of bees. "A hive mind is a distributed memory that both perceives and remembers." See Kelly, *Out of Control* (New York: Addison-Wesley Publishing Company, 1994), pp. 5-28.

[88] Ibid., p. 10.

[89] Beckerman, pp. 8-9.

[90] Maturana and Varela, p. 298.

[91] See D. Clayton James's *The Years of MacArthur: Volume III Triumph and Disaster 1945-1964* (Boston: Houghton Mifflin Company, 1985), pp. 486-606.

[92] Beckerman. For further reading on the 1993 US seizure operation of Aidid's clansmen see Mark Bowden's *Blackhawk Down* (New York: Atlantic Monthly Press, 1999).

[93] James J. Schneider, "How War Works: The Origins, Nature, and Purpose of Military Theory," *Military Theory Readings* (Fort Leavenworth: U.S. Army Command and General Staff College, Academic Year 1999-2000), p. 5.

[94] Friedrich, p. 349.

[95] The terms survive and survival speak to a systems' ability to adapt and prosper. For example, a bacteria's ability to develop internal changes within its system in order to negate the effects of antibiotic illustrates adaptation. Further, the development of new strains of bacteria through numerous life cycles illustrates promulgation and ability to prosper amidst the nullifying affect of an antibiotic, with adaptation as a precursor. This example illustrates a bacteria's ability to maximize sustainability.

[96] The interconnectedness of a military system also speaks to its connection with the political system. The unique aspect of military warfare is that a military system can survive organizationally and win tactical battles and accomplish tactical missions but, at the strategic level, it cannot guarantee political success.

[97] James J. Schneider, "What If We Fight Tonight?" p. 3.

[98] Roy E. Appleman, *East of Chosin* (Texas: Texas A&M University Press College Station, 1987), p. 3.

[99] Edwin P. Hoyt, *The Day the Chinese Attacked* (New York: Paragon House, 1993), pp. 91-92.

[100] S.L.A. Marshall, *The River and The Gauntlet* (New York: Time Incorporated, 1990), p. 16.

[101] Roy E. Appleman, *Escaping the Trap: The US Army X Corps in Northeast Korea, 1950* (Texas: Texas A&M University Military History Series, 1990), p. 14.

[102] The title of this case study comes directly from Appleman's book title, *Escaping the Trap*.

[103] Greg R. Hampton, "Captain William E. Barber, Commander, Fox Company, 7th Marine regiment, Toktong Pass, North Korea, 27 November – 2 December 1950," *Studies in Battle Command*, by the Faculty of Combat Studies Institute (Fort Leavenworth: USACGSC, 1998), p. 147.

[104] Ibid., p. 148.

[105] Ibid.

[106] Ibid.

[107] Lynn Montross and Nicholas A. Canzona, *US Marine Operations in Korea 1950-1953 Volume III: The Chosin Reservoir Campaign* (Nashville: The Battery Press, 1987), p. 180.

[108] Ibid., and Hampton, p. 149.

[109] See Appleman's *Escaping the Trap*, pp. 230-237; Hampton, pp. 149-152; Murphy, pp. 97-106; Montross and Canzona, pp. 180-195. These references provide ample examples of how accurate and timely fires and resupply operations helped Fox Company survive and sustain combat effectiveness.

[110] Murphy, p. 100.

[111] Hampton, p. 149.

[112] Marshall, *Men Against Fire*, p. 43.

[113] Edward F. Murphy, *Korean War Heroes* (Novato: Presidio Press, 1997), p. 98.

[114] Marshall, *Men Against Fire*, p. 117.

[115] Hampton, p. 149.

[116] Montross and Canzona, p. 191.

[117] Appleman, *Escaping The Trap*, p. 226.

[118] Marshall, *The River and The Gauntlet*, p. ix.

[119] Ibid., p. 2.

[120] Hoyt, p. 79.

[121] Ibid., p. 85.

[122] Marshall, *The River and The Gauntlet*, p. 4.

[123] Ibid., p. 163.

[124] Ibid.

[125] Marshall, *Men Against Fire*, p. 148.

[126] Ibid., p. 71.

[127] Ibid., p. 46.

[128] Ibid.

[129] Marshall, *The River and The Gauntlet*, p. xii.

[130] Hoyt, p. 92.

[131] Samuel B. Griffith, *Sun Tzu The Art of War* (London: Oxford University Press, 1971), p. 77.

[132] John A. Warden, III, "The Enemy As A System," *Airpower Journal*, Spring 1995, p. 47.

[133] Ibid.

[134] James J. Schneider, "Cybershock: Cybernetic Paralysis as a New Form of Warfare," *Military Theory Readings* (Fort Leavenworth: U.S. Army Command and General Staff College, Academic Year 1999-2000), pp. 12-13.

[135] Ibid.

[136] Ibid.

[137] Senge, p. 69.

APPENDIX I: Glossary[1]

(Note- Italized depicts a transliteration of a scientific term into tactical military combat realm.)

autopoiesis	The process of self-producing or self-making; an autopoietic network or pattern of organization in which the function of each component is to participate in the production or transformation of other components in the network. *The autopoietic pattern of organization for a tactical military system is analogous to the battlefield operating system (BOS).*
bifurcation point	A point of instability at which new forms of order may emerge spontaneously, resulting in development and evolution; represents a dramatic change of the system' trajectory in phase space; a new attractor may suddenly appear, so that the system's behavior as a whole bifurcates or branches off in a new direction. *An example of a bifurcation point during a battle is when a military system decides to execute a specific course of action in response to the opposing force's action. Courses of action are forms of spontaneous responses emerged by perturbation caused by an opposing force.*
combat effectiveness	*The abilities and fighting quality of a unit. (FM 34-3, p. 3-5)*
cyberneticists	Researchers who study the nature of mind;[2] patterns of communication and control—in particular on the patterns of circular causality underlying the feedback concept. The first to clearly distinguish the pattern of organization of a system from its physical structure.[3]
dissipative structures	Structure means the physical embodiment of its pattern of organization. Involves describing the system's actual physical components (shapes, chemical compositions, etc.).[4] A dissipative structure goes through new instabilities and transforms themselves into new structures of increased complexity. In open systems dissipation becomes a source of order allowing systems to maintain them selves in a stable state far from equilibrium. Able to receive energy from the outside; the instabilities and jumps to new forms of organization are the result of fluctuations amplified by positive feedback loops.[5] Maintains stable form.[6] Understood only in terms of metabolic and developmental processes.
organismic biology	The study of the nature of biological form and organization.[7]
paradigms	Accepted examples of actual scientific practice-examples of

	actual scientific practice—examples which include law, theory, application, and instrumentation together—provide models from which spring particular coherent traditions of scientific research; a paradigm is what the members of a scientific community share, and conversely, a scientific community consists of people who share a paradigm.[8]
pattern of life	Network pattern capable of self-organization.
pattern of organization	A configuration of relationships characteristic of a particular system; involves form, qualities; a configuration of ordered relationships; nonmaterial and irreducible; common to all living systems is a network of pattern; network is non-linear with non-linear relationships. These networks may have feedback loops that may give a system the ability to regulate. [9] Configuration of relationships among the system's components that determines the system' essential characteristics. Abstract mapping of relationships.[10] Not a set of relations among static components but a set of relations among processes of production of components.
process of life	The activity involved in the continual embodiment of the system's pattern of organization. Cognitive in nature. To live is to know. Living is a process of cognition.
regulate	Facilitated by feedback loops in systems; facilitates correction of mistakes and organization; and self-regulation.
self-bounded	A living system that creates its own boundary.[11]
self-generating	A living system's network goes through processes that produces its own components.[12]
self-organization	Spontaneous emergence of ordered patterns; spontaneous emergence of new structures and new forms of behavior in open systems far from equilibrium, characterized by internal feedback loops and described mathematically by nonlinear equations.[13]
self-perpetuating	The production processes continuing over time, so that the systems' processes of transformation continually replace all components.[14]
systems	Complexes of elements standing in interaction.[15]
teleology	The study of purpose and design in nature.

[1] (1) Humberto R. Maturana and Francisco J. Varela, *The Tree of Knowledge: The Biological Roots of Human Understanding* (Boston: Shambhala, 1998) p. 27; and (2) Fritjof Capra, *The Web of Life: A New Scientific Understanding of Living Systems* (New York: Anchor Books Doubleday, 1996), p. 162.
[2] Capra, p. 95.
[3] Capra, p. 157.
[4] Capra, p. 158
[5] Capra, p. 89.
[6] Capra, p. 169.
[7] Capra, p. 95.
[8] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962), pp. 10 and 176.
[9] Capra, pp. 80-82.
[10] Capra, p. 158.
[11] Capra, p. 208.
[12] Capra, p. 208.
[13] Capra, p. 85.
[14] Capra, p. 208.
[15] Ludwig von Bertalanffy, *General System Theory: Foundations, Development, Applications* (New York: George Braziller, 1968), p. 33.

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